The M2010 Standard is now in its final form. There may be some editorial changes in the text before it is published in booklet form but the testing and other requirements will not be affected.

This standard introduces a change in the way helmets will be tested rendering M2010 and M2005 incompatible. It may be no surprise that some M2005 qualified helmets will not meet M2010 but, because of the changes, it is also highly likely that some helmets meeting M2010 will not meet M2005. Since M2005 and M2010 are not compatible, meeting M2010 requirements, of itself, will not qualify a helmet to be produced and distributed with M2005 labeling. Any M2010 helmet distributed with M2005 labeling must also have met requirements in M2005 testing. Furthermore, many manufacturers may require additional time to develop lines of M2010 headgear. For these reasons, the Foundation proposes a longer transition time between M2005 and M2010. M2010 will be introduced a year earlier than in previous revisions and M2005 will be discontinued a year later.

M2010 Introduction

- Certification Testing starts..... March 1, 2008
- M2010 Labels Available..... ~~July 1, 2009~~ April 1, 2009
- First M2010 Helmets Available for Sale..... October 1, 2009

M2005 Termination

- Certification Testing ends.....June 30, 2011
- M2005 Labels last available..... June 30, 2011
- M2005 Production ends..... March 31, 2012

Important Differences

- Significant changes to impact testing - see below
- Labeling - helmets must be marked with the largest and smallest appropriate head circumferences in centimeters.
- Numbers of Samples - depending on the helmet's intended size range; seven samples may be required for certification testing.
- Model lines meeting M2010 might also be able to meet ECE 22-05 requirements and qualify for distribution and sale in Europe.

Impact Test Differences

The differences between M2010 and M2005 all stem from a reevaluation of impact test head forms. M2005 and previous standards required impact testing on head forms with an effective mass of 5.00 kg regardless of head form circumference. M2010 calls for impact testing on head forms for which the effective mass depends on head form size. M2005 invoked head forms meeting the mass and geometries specified in ISO Draft International Standard 6220, the same as those in the British Standards Institute 6658-1985 standard. This BSI 6658 standard was once mandatory for motorcycle helmets in England. M2010 calls out head forms matching the mass specifications in ECE 22-05, the current mandatory motorcycle helmet standard throughout Europe.

This reevaluation of head form mass is supported by a study conducted at the University of Washington by Dr. Randal Ching. Dr. Ching performed measurements on 15 cadaveric heads and found a strong correlation between head mass and circumference. This correlation

approximates a cubic mass versus circumference relationship and suggests that the ECE 22-05 mass specification would enable a more precise fit between the properties of Snell certified helmets and the needs of their wearers across a broad range of different head sizes.

Imposing this new mass specification on Snell standards requires a host of changes to the testing, the test criteria as shown in the following table. The second row in the table shows the test head forms. Five of these should be familiar but the C head form is new. It has been added to fill the gap between the A and E head forms. Since the drop mass had been the same for all head forms previously, the 4 cm jump in head circumference between A and E had not been a problem. In M2005, if a helmet met requirements on a larger head form, the same helmet would obtain comparable results on smaller head forms. But for M2010, there will also be a 1.0 kg gap between the A and the E head forms and the difference in test results will be pronounced. For this reason, the C head form has been selected to fill that gap and mass properties have been assigned by interpolation across the ECE 22-05 values.

M2010 Impact Testing							
Head Form		A	C	E	J	M	O
Circumference		50 cm	52 cm	54 cm	57 cm	60 cm	62 cm
Drop Mass		3.1 kg	3.6 kg	4.1 kg	4.7 kg	5.6 kg	6.1 kg
Test Criteria	Certification	275 G	275 G	275 G	275 G	264 G	243 G
	RST	285 G	285 G	285 G	285 G	273 G	251 G
Certification Velocities	1st	7.75 m/s	7.75 m/s	7.75 m/s	7.75 m/s	7.75 m/s	7.75 m/s
	2nd	7.09 m/s	7.09 m/s	7.09 m/s	6.78 m/s	5.73 m/s	5.02 m/s
Deviation Velocities	1st	7.48 m/s	7.48 m/s	7.48 m/s	7.48 m/s	7.48 m/s	7.48 m/s
	2nd	6.85 m/s	6.85 m/s	6.85 m/s	6.55 m/s	5.54 m/s	4.84 m/s

The impact test criteria are shown in the fifth and sixth rows. The certification test criteria for the medium and smaller sizes, head forms A through J, are all set to 275 G. The value comes directly from ECE 22-05. But this 275 G value, combined with the head form mass changes, would allow larger helmets to transmit more shock than allowed by M2005. So, for the M and O head forms, the largest sizes, the peak G levels have been reduced even further to assure that M2010 never allows any more shock than the Foundation allowed previously.

The certification velocities replace the impact energy requirements of previous Snell standards. The energy requirements in M2005 effectively demanded impact velocities of approximately 7.75 m/sec followed by 6.62 m/sec. Since there is no reason to believe that impact velocity will depend on a riders head size, we kept the M2005 impact velocities as a starting point in the development of M2010. However, the different impact masses must necessarily impose progressively greater levels of stress within the helmet structure as head form mass increases. Therefore, smaller sized helmets will be able to satisfy the test criteria in M2010 at higher impact velocity levels than larger helmets. Since, like previous Snell standards, M2010 will call out double impacts, the first certification impact will be at 7.75 m/sec regardless of head form size. The second impacts for the A, C and E head forms are set to 7.09 m/sec but are set progressively

lower for the J through O head forms to allow for the limits of current materials and design technology.

The RST test criteria are uniformly higher than the certification criteria in order to ensure that, during standards enforcement, measurement uncertainty will not reasonably cause a good helmet to fail. However, RST testing calls for the same impact velocities as certification and which are also subject to measurement uncertainties. If velocity uncertainty should cause a helmet to fail in RST, the matter will be set tight in a second round of enforcement testing.

When a helmet fails in RST, three more samples are tested to confirm that failure. The same RST criteria apply but these samples are tested at deviation level velocities which are uniformly lower than certification test velocities. If all three samples meet the test requirements, the previous RST failure will be considered anomalous. But if any of the samples fails, the failure cannot reasonably be attributed to velocity or to shock measurement uncertainty. Instead, the sample will be judged non-compliant and the manufacturer will be referred to the designated officer on the Foundation's board of directors for further action.

Retention Strength Testing

The retention strength test now calls for the helmet sample to be supported on its lower edge. This is intended to eliminate and testing artifact due to liner compression. However, if the technician deems that the helmet edges cannot adequately support the helmet for this test, he shall perform the test with the helmet supported by an appropriate head form.

Helmet Sizing Concerns

Helmets must meet requirements over their entire range of head sizes. In previous Snell standards, if a helmet met impact requirements on the largest appropriate head form, it would also meet them reliably on smaller test head forms. But, for M2010, helmets must be tested on the largest and smallest appropriate head forms if there is to be any confidence that helmets will meet requirements reliably throughout their intended size ranges. We have a procedure for determining the largest head form a helmet will fit but, unfortunately, I know of no good way to determine which might be the smallest head form. Instead, M2010 will require manufacturers to declare the intended size range of each helmet submitted for certification.

Helmet sizing information should be in terms of the smallest and largest head circumferences, in centimeters, for which the helmet is appropriate. Fractional values will be rounded down to the next whole centimeter but the largest size will be considered to include head circumferences up to but not including the next whole centimeter value. Once a helmet is certified, all units produced and distributed must be labeled with the size range in terms of centimeters of head circumference. These labels may indicate size ranges narrower than the declaration made for certification but must not indicate any sizes outside the original declaration. If only a single value of circumference is given, it will be accepted as the both the smallest and largest appropriate values.

If the helmet is sized so that only a single head form is appropriate for testing, M2010, like M2005, requires five samples fitted for the largest intended head size. But if the helmet's intended size range implies that two or more head forms are appropriate, M2010 demands two

additional samples fitted for the smallest appropriate size. The following table shows the head forms considered appropriate to head size ranges given in terms of centimeters of circumference. If a helmet's specified size range falls into one of the light gray cells along the table's principal diagonal, only a single head form is deemed appropriate and only five samples fitted to the largest intended size are necessary. Otherwise, two or more head forms are indicated and the manufacturer must provide two additional samples fitted to the smallest intended head size.

Test Head Forms as Determined by Size Specification (Head Circumference in cm)							
		Largest Size Specified					
		50 -	52 - 53	54 - 56	57 - 59	60 - 61	≥ 62
Smallest Size Specified	< 52	A	A-C	A-E	A-J	A-M	A-O
	52-53		C	C-E	C-J	C-M	C-O
	54-56			E	E-J	E-M	E-O
	57-59				J	J-M	J-O
	60-61					M	M-O
	≥ 62						O

M2005 and M2010

M2005 and M2010 are, effectively, incompatible. Newton's 2nd Law, force equals mass times acceleration, is at the root of it. Smaller sized helmets certified to M2005 will have trouble meeting M2010 requirements on lighter head forms and smaller sized helmets certified to M2010 will have trouble meeting M2005 on 5.00 kilogram head forms. Even so, the M2005 standard and the helmets certified to it will continue to have the full faith and support of the Foundation. The excellent safety record achieved by helmets certified to M2005 and to previous Snell standards continues. However, in the future, the Foundation's M standards will seek superior head protection along a different path.

There is a compelling reason for this break with a successful tradition: Snell standards are voluntary but must coexist with applicable regional, national, and international regulations. Unless Snell certified helmets satisfy local governmental demands, they cannot reasonably be sold or worn within that locality. Until now, Snell M standards and ECE 22-05, the motorcycle helmet standard currently mandatory through out England and Europe, were incompatible. Helmets, particularly in the smaller sizes, might meet one or the other but not both. Snell certified models could not readily be sold in Europe but ECE 22-05 helmets, beefed up for DOT compatibility, were turning up in increasing numbers in North America. As a result, the Foundation could not fulfill its commitment to better helmets for motorcyclists everywhere and Snell Certified manufacturers were obliged to produce different, less protective head gear to serve their European markets.

Although adopting the ECE 22-05 head form mass specification would resolve the incompatibility, this could not be done lightly. Snell had subscribed to an older specification and had achieved great success with it. Since there was little anthropometric data available to support either specification, the Foundation's choice, until recently, was decided by the proven protective performance of helmets certified to previous Snell standards. It was not until Dr. Ching's findings demonstrated that the Foundation could resolve that incompatibility and, at the

same time, maintain protective capabilities that the directors could finally act. On the basis of Dr. Ching's evidence, we have drafted M2010 to provide protection comparable to M2005 and to allow Snell certified helmets to qualify for sale and use in England and Europe.

As in previous revisions, if a rider has a good Snell M2005 helmet, he need not run out looking for Snell M2010. And if he is looking for a helmet and finds a new Snell M2005 that fits well and won't set his friends laughing, he'd do well to stop looking right there. But, for street riders in England and Europe, M2010 may make a considerable difference. For the first time in years, they may be able to choose helmets which satisfy all the local regulations and provide a premium of protective capability over and above local requirements.